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MINI-FOCUS ISSUE: TRANSCATHETER INTERVENTIONS

ADVANCED

CASE REPORT: CLINICAL CASE

Emergency Alcohol Septal Ablation for Shock After TAVR

One More Option in the Toolbox

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ABSTRACT

We hereby report a case of severe shock from left ventricular outflow tract obstruction following transcatheter aortic valve replacement that did not respond to medical therapy and had to be treated with emergent alcohol septal ablation (ASA). Emergent ASA should be considered for bail-out treatment for these refractory cases. (**Level of Difficulty: Advanced.**) (J Am Coll Cardiol Case Rep 2021;3:853–8) © 2021 The Authors. Published by Elsevier on behalf of the American College of Cardiology Foundation. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

HISTORY OF PRESENTATION

A 74-year-old female patient was referred to our hospital for evaluation of worsening dyspnea on exertion. Her physical examination showed a grade 4/6 systolic ejection murmur with absent S2.

PAST MEDICAL HISTORY

The patient has a medical history of coronary artery disease with prior percutaneous coronary intervention to her right coronary artery, hypertension, hyperlipidemia, and obstructive sleep apnea on home continuous positive airway pressure.

LEARNING OBJECTIVES

- LVOTO or suicide left ventricle should be in the differential for severe shock after TAVR.
- If medical treatment with fluids, beta-blockers, and phenylephrine is not effective, emergent echo-guided ASA should be considered.

DIFFERENTIAL DIAGNOSIS

Severe aortic stenosis and hypertrophic cardiomyopathy.

INVESTIGATIONS

Her echocardiogram was poor quality secondary to her body habitus, but showed normal left ventricular ejection fraction, calcified and severely restricted aortic valve, asymmetric upper septal hypertrophy (**Figure 1**) with mild left ventricular outflow tract (LVOT) obstruction (intracavitary gradient of 23 mm Hg, no provocation with Valsalva on echocardiogram), and severe aortic stenosis parameters. Because of the poor quality of her echocardiogram,

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ABBREVIATIONS AND ACRONYMS

ASA = alcohol septal ablation

LVOT = left ventricular outflow tract

LVOTO = left ventricular outflow tract obstruction

TAVR = transcatheter aortic valve replacement

further hemodynamic evaluation with invasive catheterization was performed. Just below the aortic valve, the peak-to-peak gradient was 56 mm Hg and mean gradient of 34 mm Hg with calculated aortic valve area of 0.42 cm^2. There was no intracavitary gradient on the day of the invasive catheterization study.

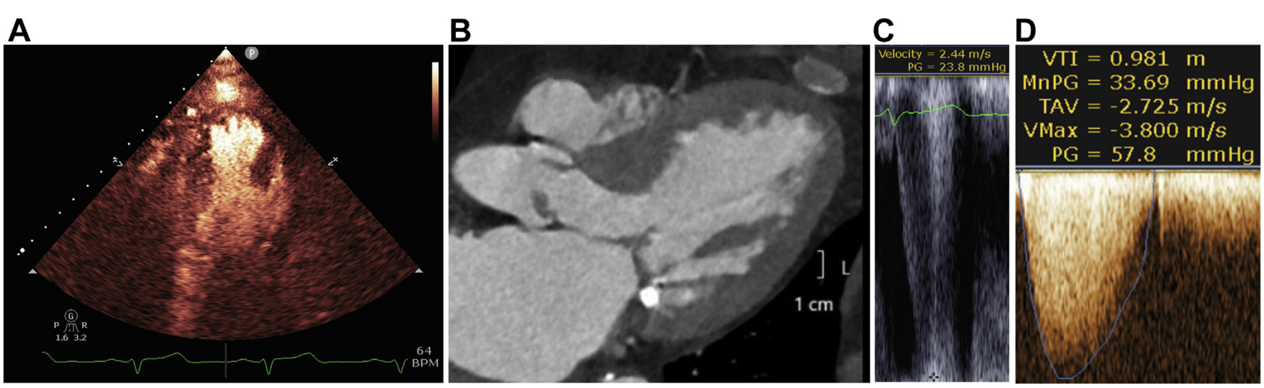
MANAGEMENT

The patient was referred for transfemoral transcatheter aortic valve replacement (TAVR). Intraprocedurally, very similar hemodynamic gradients were recorded with peak-to-peak gradient of 58 mm Hg and mean gradient of 35 mm Hg (Figure 2A). Transfemoral TAVR was conducted as usual, and after deployment of the 23-mm Edwards Sapien valve, the recorded gradient was eliminated (Figure 2B); however, the patient became hypotensive and started complaining of severe chest pain and shortness of breath. Prompt evaluation (included aortogram, peripheral angiogram, and an emergency echocardiogram) revealed no coronary obstruction, cardiac tamponade, severe paravalvular leak, or access site bleeding. The transthoracic echocardiogram, albeit with poor windows secondary to body habitus, showed LVOT obstruction (LVOTO) and systolic anterior motion of the mitral valve. Further hemodynamic assessment revealed peak-to-peak left ventricular-aortic gradient of 60 mm Hg with positive Brockenbrough sign and an increased gradient to 120 mm Hg (Figures 2C and 2D) compatible with LVOTO or suicide left ventricle. Aggressive medical therapy was initiated with fluids, beta-blockers, and phenylephrine without any success. Because of continuous decline in the patient's clinical status, the decision was made to pursue emergent alcohol septal ablation (ASA). A 6-F JL4 guide was engaged in the left main and the first septal perforator was mapped (with live echocardiography guidance) to the asymmetric basal septum and then was injected with 1 mL isopropyl alcohol (Figure 3) guided by bedside transthoracic echocardiogram (Figure 4). Subsequent angiography revealed occlusion of the injected septal perforator. Repeat hemodynamic assessment after ASA showed resolution of LVOTO, a negative Brockenbrough sign (Figure 2E), normalization of blood pressure, and resolution of symptoms. The patient was monitored in the intensive care unit for 1 night and was discharged on post-operative day 3.

FOLLOW-UP

Follow-up echocardiogram revealed LVOT gradient of 25 mm Hg without any provocation. No atrioventricular block was seen post-operatively or at follow-up.

FIGURE 1 Baseline Thoracic Echocardiogram and CT



(A) Echocardiogram (difficult quality) shows mild asymmetrical hypertrophy in the basal septum. **(B)** CT transcatheter aortic valve replacement showing asymmetrical hypertrophy in the basal septum. **(C)** Pulsed-wave Doppler showing mild baseline left ventricular outflow tract obstruction (23 mm Hg) without provocation and **(D)** continuous-wave Doppler showing severe aortic stenosis (paradoxical low-flow low-gradient). CT = computed tomography.

FIGURE 2 Hemodynamic Tracings

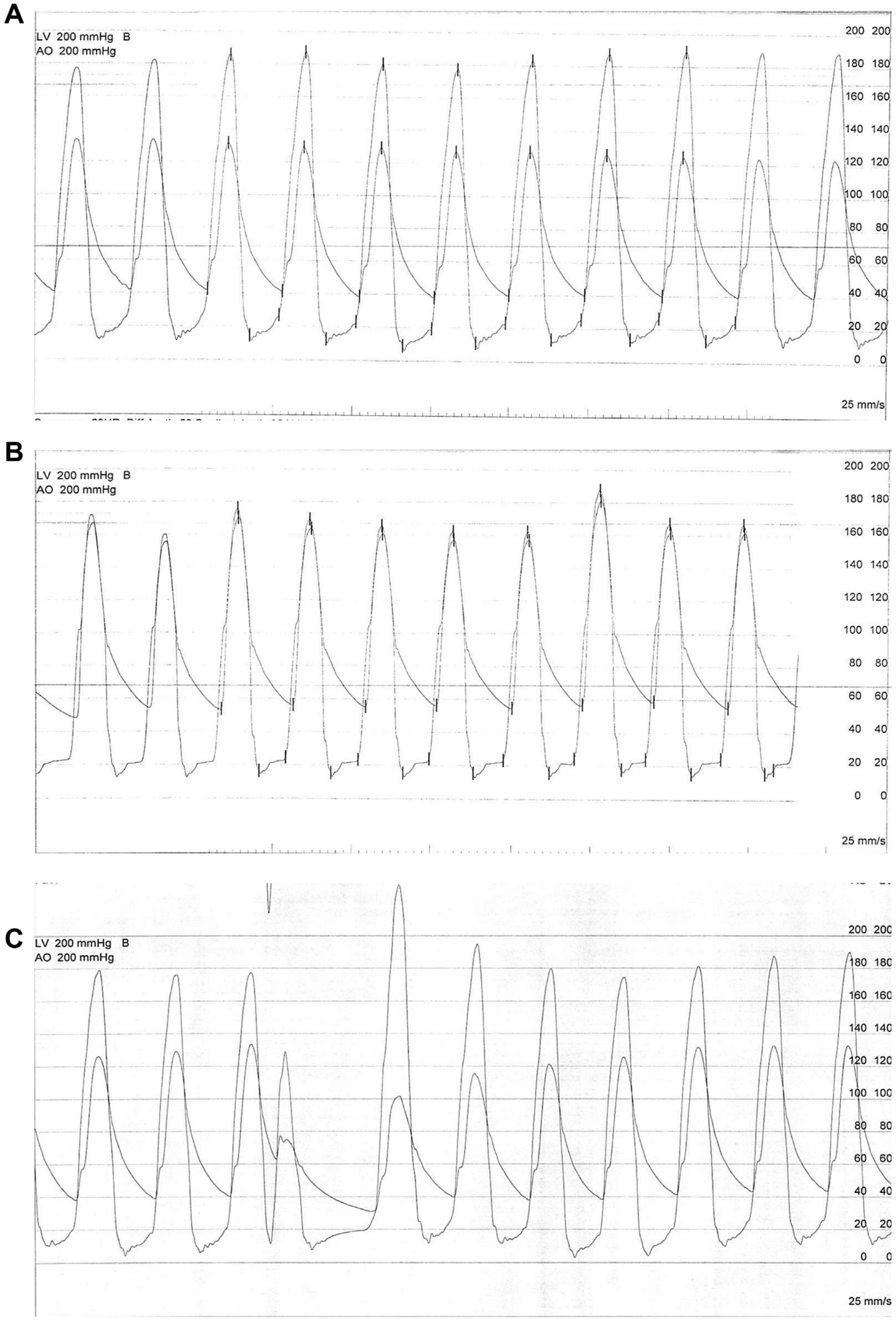


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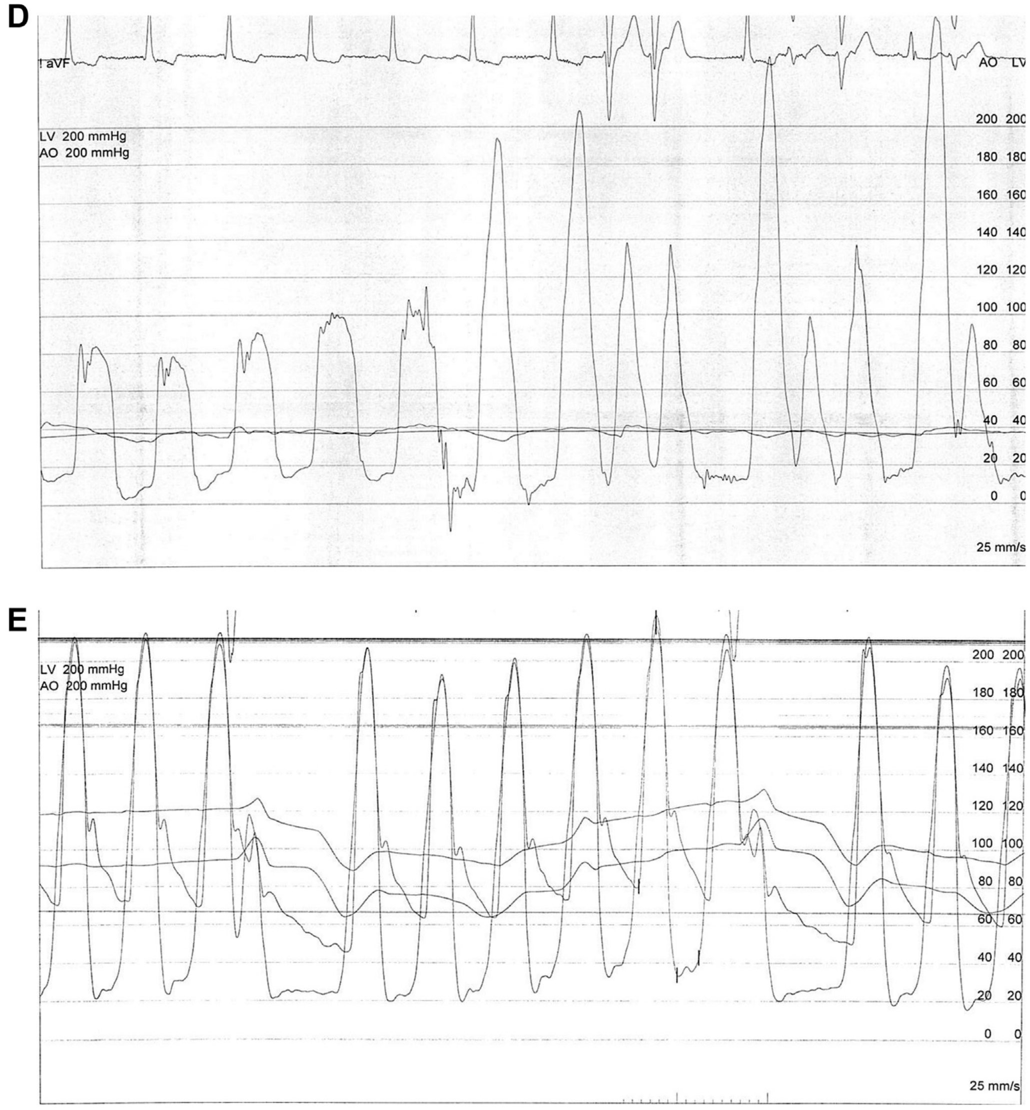
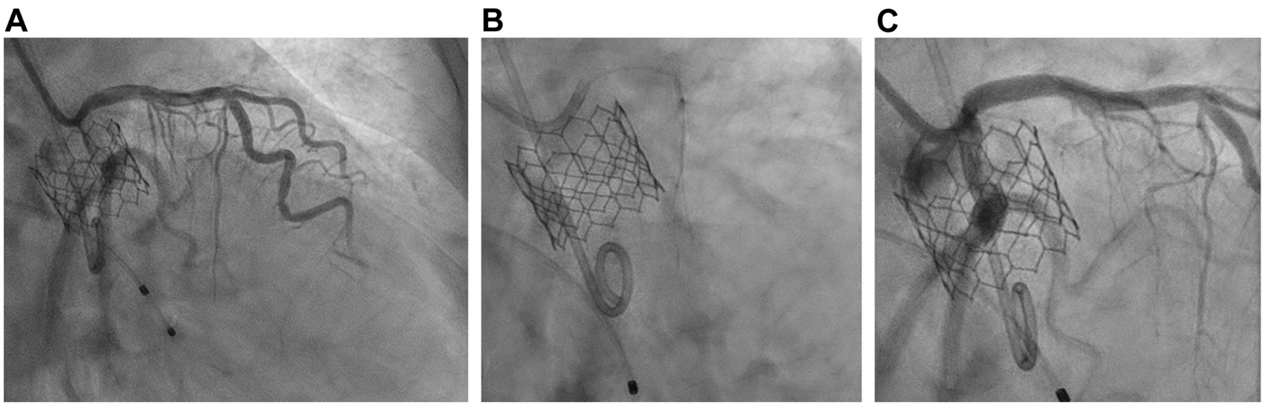
FIGURE 2 Continued



(A) Hemodynamic tracing of the left ventricle-aorta (LV-AO) at baseline before transcatheter aortic valve replacement (TAVR) and placing the pigtail catheter just below the valve to avoid contamination with the left ventricular outflow tract (LVOT) gradient. This tracing confirms diagnosis of severe low-flow low-gradient aortic stenosis. **(B)** Hemodynamic tracing of the LV-AO after TAVR and placing the pigtail catheter just below the valve to avoid contamination with the LVOT gradient showing successful TAVR and elimination of the severe aortic stenosis gradient. **(C)** Hemodynamic tracing of the LV-AO placing the pigtail catheter inside the left ventricular cavity showing LVOT obstruction (LVOTO). The fifth measurement demonstrates the Brockenbrough sign with increased gradient after a premature ventricular contraction. **(D)** Pull back of the pigtail catheter from the inside the left ventricular cavity to just below the aortic valve confirming severe LVOTO. **(E)** Hemodynamic tracing of the LV-AO after alcohol septal ablation (ASA) showing successful elimination of the LVOTO and no gradient. Also showing a negative Brockenbrough sign (which was positive before the ASA).

FIGURE 3 **Intraprocedural Coronary Angiogram Showing the Emergent ASA Procedure**

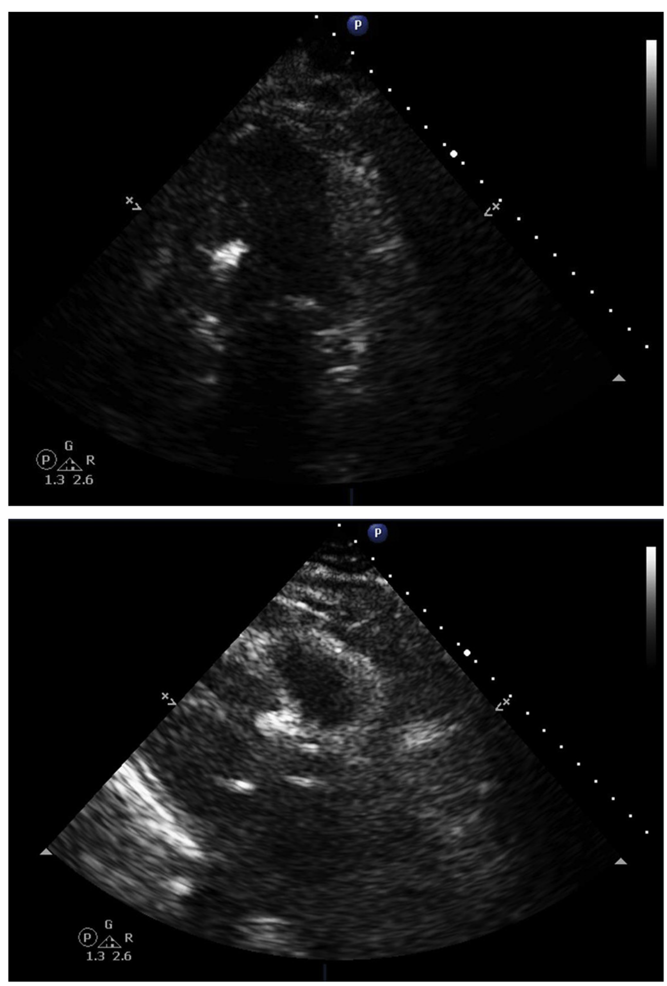


(A) Right anterior oblique projection showing the septal perforator. **(B)** Injection of the first septal perforator while through an occlusive over the wire balloon. **(C)** Post injection of alcohol showing successful ablation. ASA = alcohol septal ablation.

DISCUSSION

Aortic stenosis causes hypertrophy of the left ventricle that is often the cause of increased afterload and is concentric in most cases. However, eccentric asymmetrical hypertrophy sometimes coexists with severe aortic stenosis (1) and can pose a treatment challenge when the afterload is suddenly relieved by means of aortic valve replacement. The explanation for the sudden shock after implantation of the valve is related to the immediate reduction of the fixed afterload and the resulting acceleration of blood in the LVOT area. Medical therapy is often successful in relieving the obstruction, but reports of concomitant surgical myectomy at time of surgical aortic valve replacement for these cases has been reported (2). It is important for TAVR operators to be aware of this serious condition (suicide left ventricle) and be familiar with medical therapy as well as transcatheter treatment options (**Central Illustration**). Perhaps in patients with high likelihood of shock from LVOTO, surgery can be considered as an alternative for operable patients.

FIGURE 4 **Intraprocedural Echocardiogram Showing Mapping of the First Septal to the Base of the Septum**



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Dr. Eng has served as a clinical proctor for Edwards Lifesciences. Dr. Frisoli has served as a clinical proctor for Edwards Lifesciences. Dr. O'Neill has served as a consultant to Abiomed, Medtronic, and Boston Scientific. All other authors have reported that they have no relationships relevant to the contents of this paper to disclose.

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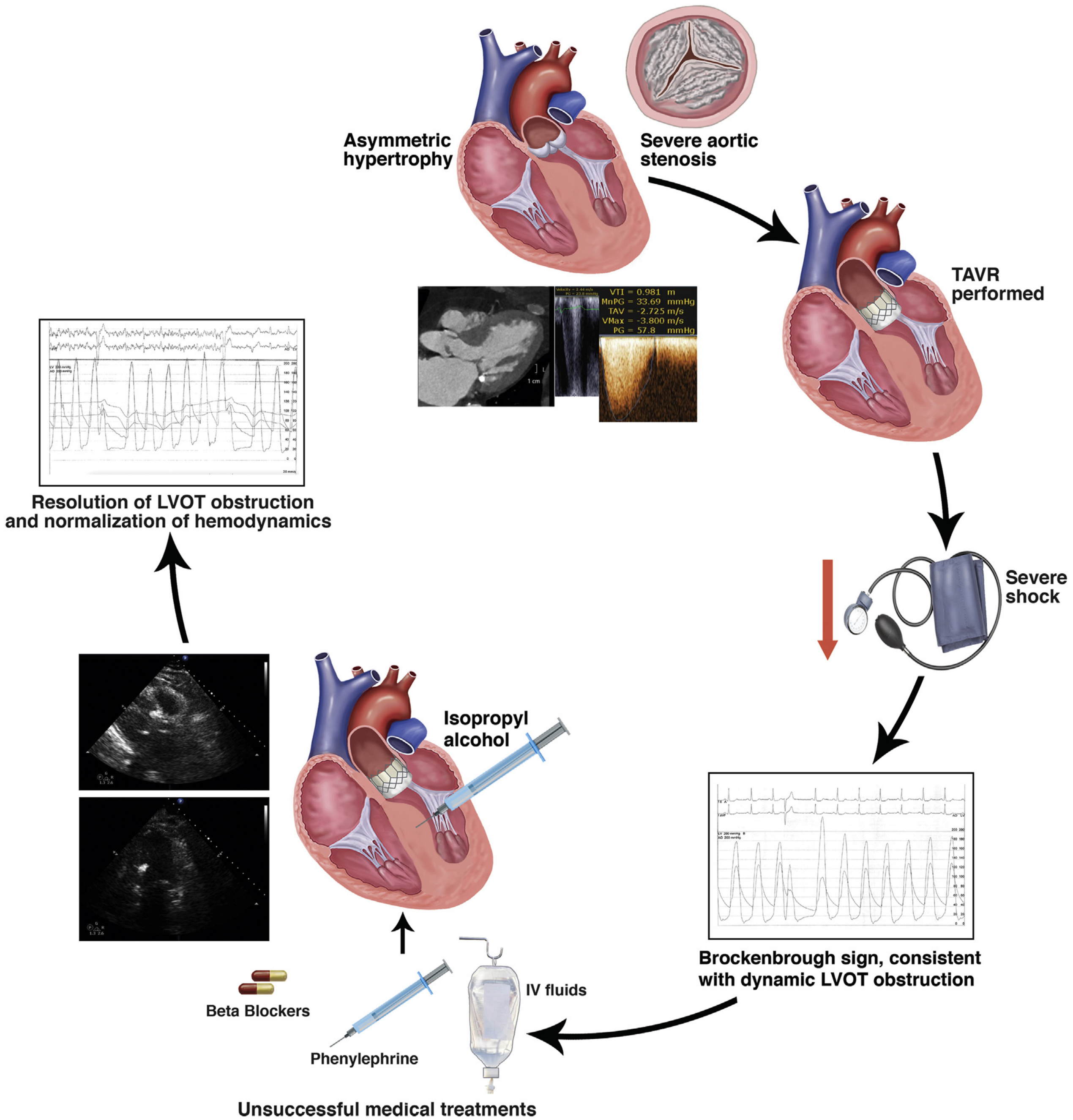
CENTRAL ILLUSTRATION **Algorithm for Treating Patients With Severe Aortic Stenosis At High Risk for LVOT Obstruction**



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KEY WORDS alcohol septal ablation, emergent, LVOT obstruction, TAVR